

# VIRTUAL BABY USED AS A VIRTUAL ENVIRONMENT FOR PATIENTS WITH SEVERE DEMENTIA

S. Yonemitsu<sup>1</sup>, K. Nakamura<sup>2</sup>, A. Itoh<sup>2</sup>, Y. Higashi<sup>1</sup>, T. Fujimoto<sup>1</sup>, T. Tamura<sup>3</sup>, K. Nakajima<sup>3</sup>,  
M. Nambu<sup>3</sup> and H. Uno<sup>4</sup>

<sup>1</sup>Fujimoto-Hayasuzu Hospital, Miyakonojo, Miyazaki Japan, <sup>2</sup>Green Home for the Elderly Nursing Home  
<sup>3</sup>National Institute for Longevity Sciences, <sup>4</sup>Koken

**Abstract** - We gave patients with severe dementia a baby-like doll to serve as a virtual baby in a therapeutic program and after dinner when the subjects missed their homes. In the therapeutic program, an occupational therapist provided the patients with two soft plastic dolls and one silicone doll, complete with dress and cap, for 90 seconds. The activities of the patients were observed by the occupational therapist and classified into four categories (no reaction, close observation, care of the doll, communication with other residents and caregivers). In the 60-minute therapeutic program, the total number of activity episodes was around 300. The dolls were also placed in the main hall after dinner, but the only patients who noticed them were those interested in the virtual babies. The patients appeared much happier and less agitated when handling the dolls. Although doll therapy is not suitable for everybody, it is a useful tool in occupational therapy.

**Keywords** - virtual environment, virtual baby, doll therapy, dementia patient, care

## I. INTRODUCTION

In the fields of medicine and rehabilitation, the most important objectives of virtual reality are to assist in curing the patient, to increase motivation, and to improve quality of life. Both physicians and engineers are interested in applying virtual environments (VE); however, few studies have been performed in the fields of clinical rehabilitation. In cancer treatment, a VE helps eliminate the patient's pain and motivates patients to train with a ligament type ergometer [1]. When the patient walks, the landscape in the VE changes in response to changes in the speed of the ergometer. The changes in the environment increase both the motivation to train, and the effect of training. VEs are very effective with assistive walkers and horse-riding simulators. The use of toy robots as virtual pets has also been introduced in clinical rehabilitation. In long-term care institutions for children, playing with pet robots assists children to return to kindergarten or school successfully.

In the care of moderate to severe dementia, occupational therapy commonly uses pet-assistive and diversional therapies [2]. Pet-assistive therapy allows dementia patients to play with live animals. In previous studies, blood pressure and heart rate decreased as a result of animal intervention. Social and psychological functions also improved. The latter studies involved both children and healthy elderly people

who lived alone [3]. In diversional therapy, an occupational therapist (OTR) uses doll therapy, in which the dementia patients are given baby-like dolls; this reminds patients of when they were younger and cared for real babies. The doll must be extremely lifelike, with a weight and shape similar to those of a real baby, so that patients will treat it like a real baby.

The aim of this study was to evaluate what kinds of dolls dementia patients consider realistic. The efficiency of doll therapy and patient activity with and without intervention are also discussed.

## II. METHODOLOGY

### A. Material

Three types of doll were used. In Fig. 1, the doll on the left (A) is the so-called Koken Baby, manufactured by Koken, of Tokyo, Japan; the middle doll (B) is Say Cheese, designed by Lee Middleton Original Dolls Inc., of Ohio, USA; and the doll on the right (C) is made by Takara, of Tokyo, Japan.

Their heights and weights are shown in Table 1. Doll A is made of silicone and feels similar to human skin. Dolls B and C have heads and limbs made of polyvinyl chloride, with stuffed bodies. The brown hair of Doll A is painted on, while that of Dolls B and C is implanted polyethylene. The neck of Doll B is flexible and must be supported when the doll is being held. The necks of Dolls A and C are fixed. The face of Doll A is anatomically accurate; the face of Doll B simulates exaggerated laughing; and Doll C has a popular face. To accentuate the figures, the dolls were dressed with the same specially designed clothes and cap.



Fig. 1. The virtual babies.

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Table 1. The characteristics of the dolls

	A	B	C
Manufacturer	Koken	Lee Middleton	Takara
Height	48 cm	50 cm	46 cm
Weight	1766 g	1452 g	1226 g
Material	Silicone	Vinyl-chloride with a stuffed body	Vinyl-chloride with a stuffed body
Neck	Fixed	Flexible	Fixed

### B. Experimental procedure

Thirteen patients (three males and 10 females) with severe dementia were given occupational therapy during the daytime. Their average age was  $90.2 \pm 5.2$  years and their average Gottfries-Bråne-Steen (GBS) scale was  $68.8 \pm 19.6$  points. They frequently wandered around the nursing home. The first study was a one-hour group study during the normal occupational therapy program. This was conducted at either 10–11 am or 3–4 pm. In the therapy room, the therapist then displayed the dolls for 90 seconds to three or four patients. The patients' activity after the intervention with the baby-like dolls was observed. The activities we identified were no reaction, close observation, care for doll, and communication with other patients. The activities were recorded on videotape. After the therapy, the recordings were played back and the activities were classified and counted using a simple barcode method[5]; while watching the recording, the occupational therapist scanned the appropriate barcode with a barcode reader. The resulting data were transferred to a personal computer and loaded into a spreadsheet for further analysis. The second experiment was carried out in a more general environment. At the nursing home, the patients used to wander or become agitated after dinner because of their desire to go home. The experimental period was 6–7 pm on two consecutive days. After gathering the patients in the hall, two therapists each held a baby-like doll in their arms at 6:10 pm and after 40 min it was withdrawn. The patients' responses to intervention with the dolls during the first 10 minutes, the next 40 minutes, and the final 10 minutes of the hour were studied. The patients' activities were observed by the OTR and classified into four categories (no reaction, glance, care for doll, communication with other residents). The total numbers of each category over the period of the program were recorded.

An individual study was also made of the patient who was the most sensitive to, and interested in, the dolls. The patient was continuously monitored for four days, with and without intervention with the dolls.

The study was approved by the Ethics Committee of Fujimoto-Hayasuzu Hospital, and written informed consent was obtained from each patient or the patient's family.

## III. RESULTS

### A. Therapeutic study

The total numbers of activities were 310, 316, and 282 for dolls A, B, and C respectively. The breakdown of the four

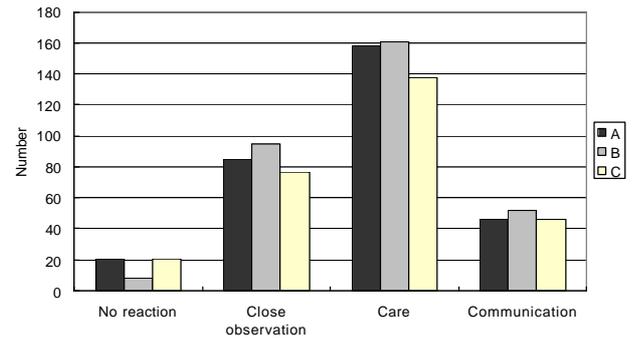


Fig. 2. Patient activity during occupational therapy intervention using dolls.

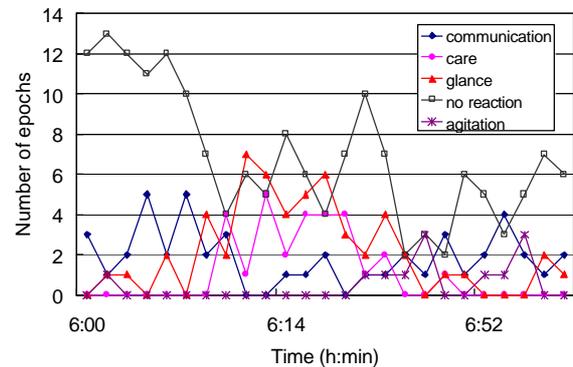


Fig. 3. Patient activity after dinner, after intervention with dolls.

different activities is shown in Fig. 2. Care and close observation were the two most frequent activities. In caring for the 'baby', touching and talking to the dolls were the most frequent activities noted in this study.

### B. General environment

Dolls A and B were taken to the hall. After this intervention, the patients showed interest in the dolls. Normally, only parents (in this case the OTR) carry babies in their arms, and only patients who sat or walked near the OTR showed significant interest in the dolls. Twenty-one patients (three males and 18 females) and 16 patients (two males and 14 females) participated on the first and second days of the experiment, respectively. The number of participants gradually decreased during the study (Fig. 3).

Fig. 4 shows the activities of one patient with (a) and without (b) Doll A. She was the patient who showed the most interest in the dolls during the therapeutic program.

During her intervention with the doll, she took extensive care of it. Without the doll, she would wander and become agitated at that time of day.

In the opinion of the OTR and a helper, the staff were able to communicate more easily and converse more when a patient in the hall carried a doll in her/his arms.

In addition, the size of the group influenced the reaction. In the group program, the patients were nervous of others and the contact time was shorter. One male patient in particular

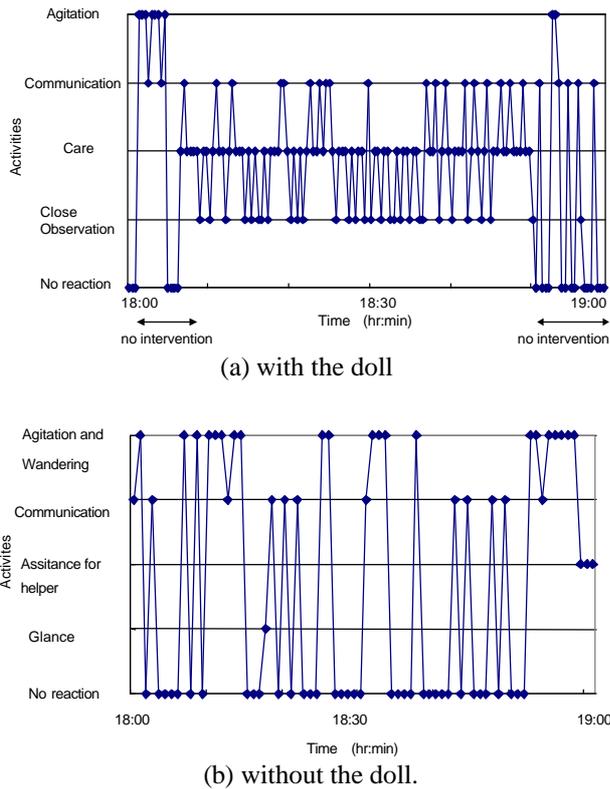


Fig. 4. A patient who reacted strongly to Doll A.

had a somewhat reserved manner towards female patients in the group. On the other hand, when only one patient remained in the therapy room, he/she made close contact with dolls of both genders. While in the hall, we clearly discerned two groups: one that was interested in the dolls and another that was not. The dolls were freely available in the hall, and thus patients who were interested in the dolls could make frequent contact with them.

#### IV. DISCUSSION

Our study applied a VE to diversional therapy. The aims of diversional therapy are to cure disease, increase motivation, remove pain, and work off frustration. In addition, it makes patients happier and more expressive, enables them to communicate better with others, promotes their rehabilitation into society, and stimulates sensation and perception. In group environments, a pet robot or a live pet can move among patients who may pay attention to it, but in this case, the OTR delivered a virtual baby in the form of a doll, which could only influence nearby patients. This was proved by the fact that the number of participants in the hall gradually decreased during the study. For individuals, the virtual baby was effective, but we question its usefulness in large groups.

After giving a doll to the severe dementia patients, the patients insisted that the virtual baby was too cute to touch. Feel is another important issue. One of the dolls (Doll A) was made of silicone, which feels the most like a real baby, although the temperature of the silicone baby should be kept close to human body temperature. Regarding hair, some severe dementia patients ate the doll's hair; to prevent this

practice, it seems preferable to use dolls with painted hair. A commercial healing baby made in Australia also has no hair. It is a 20-cm, soft-plastic, baby-like doll that is washable and has no accessories, such as woolly hair or detachable parts.

The high interest in babies was the reason that the virtual baby was loved and treated in a friendly manner by patients of both genders. Patients took care of the virtual baby as if it were real, a phenomenon known as the "doll phenomenon" or "mothering". We performed this study in a Japanese rural area, where men do not normally take care of young babies. Nevertheless, male patients loved the virtual baby. Careful attention was paid to each patient's personal history. A virtual baby is not suitable for every individual. It is necessary to determine which patients demonstrate behavior that lends itself to a caring role.

A virtual baby is simple and inexpensive compared with a pet robot or a live pet. In our study, the virtual baby therapy was effective. However, further studies are needed to [1] examine the timing of delivery and removal of the doll, [2] vary the therapeutic program in the nursing home after intervention with a virtual baby, [3] compare virtual baby therapy and conventional therapeutic programs, [4] assess the burden on caregivers and nurses, and [5] consider alternatives to the virtual baby.

Finally, quantitative evaluation of intervention with the virtual baby requires further discussion. Questionnaires and time studies are common methods of performing qualitative evaluation. However, physiological parameters must be analyzed for quantitative evaluation. For children and healthy elderly people, electroencephalograms, blood pressure, and heart rate can be measured. The appearance of specific electroencephalograms, and changes in blood pressure and heart rate are indices of patient response. For severe dementia patients, however, attaching a sensor or transducer to the body is impossible, and we need to develop a new type of sensor to evaluate the effect of therapy.

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#### REFERENCES

- [1] Ohsuga, M., Tatsuno, Y., Shimono, F., Hirakawa, K., Oyama, H., and Okamura, H. Development of Bedside Wellness System Aiming at Patients' Mental Care. *JVR Japan* 3(4):213-220, 1998 (English abstract).
- [2] Brodie S and Biley F. An exploration of the potential benefits of pet-facilitated therapy. *J Clin Nurs* 8:329-337, 1999.
- [3] Kongable LG, Stolley JM, and Buckwalter KC. Pet therapy for Alzheimer's patients: A survey. *J Long-term Care Admin* 18(3):17-21, 1990.
- [4] Gottfries, C.G., Brance, G., and Steen G. A new rating scale for dementia syndromes. *Gerontol* 28 (Suppl 2):20-31, 1982.
- [5] Higashi, Y., Nakamura, K., Yasuda, T., Fujimoto, T., and Tamura, T. Development of a simple statistical analyzer for time studies, using a barcode reader. *Occupational Therapy J (Japan)*, 34:1197-1199, 2000 (In Japanese).